

**Review of the genus *Schizopathes*
(Cnidaria: Antipatharia: Schizopathidae) with a description of a
new species from the Indian Ocean**

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Abstract.—The genus *Schizopathes* is reviewed and its relationship with other genera in the family is discussed. The genus contains two previously described species, *S. affinis* Brook and *S. crassa* Brook, and one new species described here as *S. amplispina*. *Schizopathes amplispina* can be differentiated from *S. affinis* and *S. crassa* by its larger spines and more closely spaced pinnules. *Schizopathes amplispina* is known only from the type locality in the western Indian Ocean.

In the course of examining the antipatharian collections in the National Museum of Natural History (USNM) at the Smithsonian Institution, several colonies of a species of *Schizopathes* were located which upon closer study were found to represent a new species. This is the first new species added to the genus since its establishment by Brook in 1889. The type specimens, which were collected by the R/V *Anton Brunn* in the Indian Ocean east of Madagascar, are deposited at the Smithsonian Institution, Washington, DC.

Schizopathidae (Brook, 1889)

Diagnosis.—Antipatharians with polyps transversely elongated and subdivided by “mesogloal septa” into three sections, each bearing one pair of tentacles (Brook 1889). Middle section of each polyp with sagittal tentacles, mouth, stomodeum (actinopharynx), and six primary and four secondary mesenteries. Lateral sections of each polyp with pair of lateral tentacles and single transverse mesentery containing reproductive cells.

Remarks.—The Schizopathinae was originally established by Brook as one of two

subfamilies in the family Antipathidae. Included in the subfamily were the genera *Schizopathes*, *Bathypathes*, *Cladopathes*, and *Taxipathes*. The basis for subfamily recognition by Brook was the division of each polyp along the transverse axis into three sections each bearing one pair of tentacles, and which Brook regarded as dimorphic zooids (i.e., two gonozooids and one gastrozoid for each polyp). In *Schizopathes* these divisions of a polyp are associated externally with “peristomal involutions” (constrictions of the coenenchyme between the sagittal and lateral tentacles) and internally with “mesogloal septa” (also referred to as peristomal partitions by later workers) placed at right angles to the transverse axis of the polyp (Brook 1889). Most later workers have not considered this a case of true dimorphism but rather one of polyp modification and specialization, with the reproductive tissues being isolated in the lateral chambers of the coelenteron (Thompson 1905, van Pesch 1914). There are other antipatharian genera such as *Parantipathes* in which the polyps are elongated along the transverse axis and in which the reproductive organs are located at the distal and proximal ends of the primary

transverse mesenteries; however, all the genera originally placed in the subfamily Schizopathinae presumably had "mesogloal septa" which further isolated the distal and proximal coelenteral chambers of each polyp. It should be noted, however, that Brook did not provide as detailed a description of the internal anatomy of the polyps of *Bathypathes*, *Cladopathes*, and *Taxipathes* as he did for *Schizopathes*. Although the polyps of these genera are elongated transversely (in some cases to a greater degree than that occurring in *Schizopathes*), the occurrence of internal "mesogloal septa" was not specifically mentioned by Brook. Brook did report, however, that the polyps of *Bathypathes* and *Taxipathes*, like those of *Schizopathes*, possessed 10 mesenteries, six primary and four secondary; the number, location and arrangement being identical to that occurring in the family Antipathidae. The polyps of *Cladopathes* were described as having six primary mesenteries but no secondaries.

In his revision of the order, Schultze (1896) divided the family Antipathidae into three subfamilies based on the number of mesenteries in the polyps; the Dodekamerota with 12 mesenteries, the Dekamerota with ten mesenteries, and the Hexamerota with six mesenteries. The Dekamerota were further divided into two unnamed tribes, one of which contained *Schizopathes*, *Bathypathes*, and *Taxipathes*. The genus *Cladopathes* was placed by Schultze (1896) in the new subfamily, the Hexamerota. van Pesch (1914) renamed Schultze's Dekamerota as the Heterotaeniales and established the name Ptuchaephora for the tribe containing *Schizopathes*, *Bathypathes* and *Taxipathes*. Other workers, however, have taken the opposite approach and elevated the Schizopathinae to the family level (Hickson 1907, Pax 1918). With the recent removal of the Dendrobrachiidae from the Antipatharia (see Opresko & Bayer 1991), family level distinctions within the order need to be reevaluated. Based on the pronounced transverse elongation of the pol-

yps, the recognition of the Schizopathidae as a distinct family seems appropriate; however, further investigation is needed into the importance of the "mesogloal septa" as a family level character.

Schizopathes Brook, 1889

Schizopathes Brook, 1889:146.—Hickson, 1907:6.—Cooper, 1909:308.—Pax, 1918:468.

Bathypathes.—van Pesch 1914:27 (part).—Pasternak, 1977:157 (part).—Zhou & Zou, 1992:46 (part).

Type species.—*Schizopathes crassa* Brook, 1889. Brook (1889) does not specifically designate a type species for any of his new genera; however, he makes the statement that the type species of all but one of the genera were examined microscopically (Brook 1889:75). Of the three species that Brook referred to *Schizopathes*, only *S. crassa* was evaluated histologically (Brook 1889:46); therefore, by inference, it can be concluded that *S. crassa* is the type species of the genus.

Diagnosis.—Colony monopodial, unbranched, but pinnulate. Pinnules simple, arranged alternately and bilaterally; decreasing in length towards top of corallum. Basal section of stem not pinnulated, but modified to serve as holdfast in soft sediments; upper part laterally compressed in plane at right angles to plane of pinnules; lower part curved away from polyp side of colony, sometimes spatula-like near base. Spines usually simple (rarely bifid), smooth, and triangular in lateral view. Polyps crowded, arranged in a single row usually on the upper side of the pinnules, and elongated transversely; transverse diameter (from distal side of distal lateral tentacles to proximal side of proximal lateral tentacles) usually greater than 2.5 mm.

Remarks.—Brook originally placed three species in *Schizopathes*, *S. crassa*, *S. affinis*, and *S. conferta*. The type material of the first two species consisted of complete colonies with the unique basal holdfast intact.

Schizopathes conferta was described from an incomplete specimen in which the bottom and top parts of the corallum were missing. Although the polyps of *S. conferta* were described by Brook as being very similar to those of the other two species in the genus, the absence of the holdfast, and the very narrow internal angle formed by the lateral rows of pinnules suggest that *S. conferta* may actually be a specimen of the related genus *Bathypathes* in which the corallum is attached permanently to the substrate by a basal plate. Brook stated that he could not determine if *S. conferta* had been attached by a basal plate.

Excluding *S. conferta* from consideration, features that are consistent among species of this genus are: the unique basal holdfast; the regular decrease in the length of the pinnules higher up on the corallum; the simple, triangular, laterally compressed spines; and the transversely elongated polyps. Features which have been used to separate species of the genus include the size of the polyps and spines and the density of the pinnules. In all *Schizopathes* species there is a strong tendency for the pinnule density to increase towards the top the corallum and for the spines and polyps to be largest along the distal parts of the pinnules; however, these characteristics vary considerably from specimen to specimen and even with the same colony.

It should be noted that some earlier workers such as van Pesch (1914) relegated the genus *Schizopathes* to subgeneric status within *Bathypathes*, and Pasternak (1977) even synonymized two of the three species described by Brook (*S. crassa* and *S. affinis*) with *Bathypathes patula* Brook. The latter decision was based on the assumption that the type of holdfast formed by the colony was simply a function of the type of substrate on which the planulae settled. Although there are similarities in terms of pinnulation pattern and size of the polyps and spines, the very distinctive basal holdfast of all the species of *Schizopathes* (that have been described from complete specimens)

would argue for their being recognized as a separate genus.

Schizopathes crassa Brook, 1889

Fig. 1

Schizopathes crassa Brook, 1889:147–148, pl. VIII, figs. 1–5.

Bathypathes (Schizopathes) affinis.—van Pesch, 1914:27–29 (part).

?*Schizopathes crassa*.—Hickson, 1907:6 (incomplete colony).

Material examined.—SW Indian Ocean, S of Tasmania, 58°06'S, 144°55'E, 3089–3164 m, USNS *Eltanin* sta. 126, 1 Oct. 1965 (1 specimen, USNM 78796).—Antarctica, NW of Balleny Ids, 64°59'S, 160°36'E, 2836–2864 m, USNM *Eltanin* sta. 1957, 7 Feb. 1967 (1 specimen, USNM 78820).—SE Indian Ocean, 55°01'S, 39°55'E, 2886–3040 m, USNS *Eltanin* sta. 1537, 8 Feb. 1966 (2 specimens, USNM 78810).

Description.—Colony monopodial, unbranched, but pinnulate (Fig. 1B). Pinnules simple, arranged alternately in two lateral rows along the stem, and decreasing in length from base to apex. Maximum length of pinnules about 20 cm on colonies 30 cm tall (total length of stem) and about 30 cm on colonies 55 cm tall. Pinnules in each row usually 10–12 mm apart on lower parts of stem; becoming more closely spaced towards apex of corallum. Interior angle formed by lateral rows of pinnules 180° over most of corallum; <180° for lowermost pair, and greater or less than 180° for several pairs at top of corallum. Distal angle of pinnules 55–60° on lower parts of corallum but ≤45° near apex.

Spines small, triangular and compressed; typically 0.06–0.08 mm tall (from midpoint of base to apex; range, 0.04–0.1 mm); arranged in rows with varying degrees of regularity; 3–5 spines per millimeter. Largest spines usually on polyp side of pinnules; abpolypar spines slightly smaller than polypar spines.

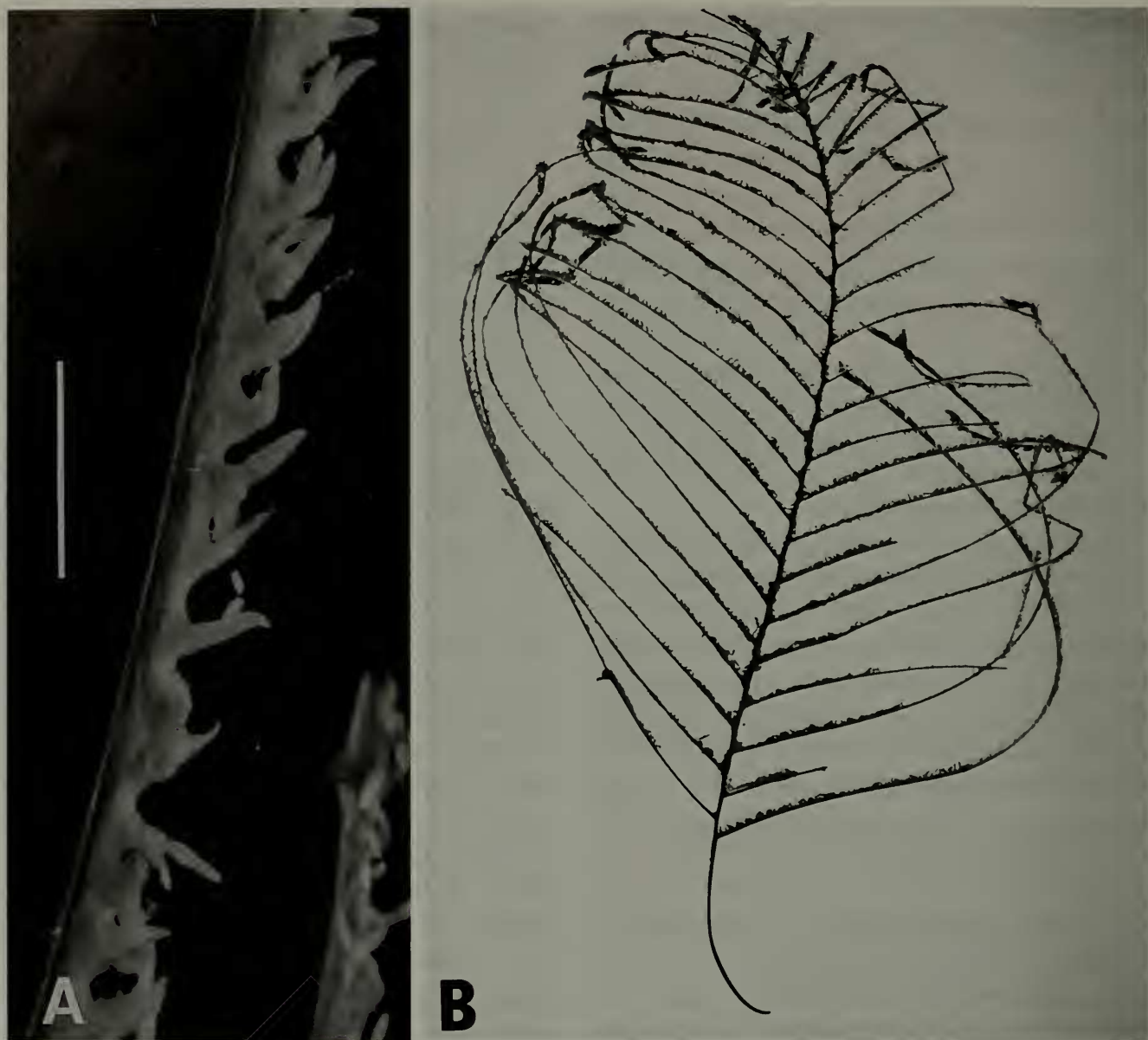


Fig. 1. *Schizopathes crassa* Brook, USNM 78820. A. Pinnule with polyps; scale equals 5 mm. B. Corallum; height 30 cm.

Polyps (Fig. 1A) 4–6 mm in transverse diameter on pinnules; ≤ 4 mm at basal end of pinnules and on stem. Polyps arranged uniserially, with two per centimeter.

Discussion.—The unpinnulated section of the stem of the type specimen of *S. crassa* was reported by Brook (1889) to be only 3.3 cm long. The unpinnulated stalks of the *Eltanin* specimens range from 6 to 8 cm. The maximum size of the spines in both the type and in the *Eltanin* specimens is about 0.1 mm. According to Brook (1889), the rows of spines on the flattened part of the stalk of the type are confined to the narrow anterior edge; however, in the *Eltanin* spec-

imens they are present on the wider sides as well.

Brook (1889) reported that the “zooids” in the type specimen measured 3 mm across the base of the tentacles, and the illustrations given of the type indicate that the total transverse width of the polyps is 6 mm. Polyps of a similar size (commonly 5 mm, but up to 6 mm in transverse diameter) are present on the pinnules of the specimen from *Eltanin* sta. 126, with smaller polyps (as small as 3 mm or less) occurring at the base of the pinnules and on the stem. In the specimens from *Eltanin* sta. 1957 and 1537, most of the polyps on the pinnules are 4–

4.5 mm and only a few are as large as 5 mm. As in the case with the other *Eltanin* specimen, smaller polyps (3–3.5 mm) occur at the base of the pinnules and on the stem.

The specimen of *S. crassa* from *Eltanin* sta. 126 (USNM 78796) is 56 cm tall with pinnules up to 31 cm long. It is unique in that the pinnules in each lateral row are spaced up to 16 mm apart on the lowermost part of the corallum and as much as 12 cm apart near the apex of the corallum. In comparison, the pinnules in the type and in the other *Eltanin* specimens are 10–12 cm apart on the lower part of the stem and 7–8 cm apart near the apex of the corallum.

Comparisons.—See description of *Schizopathes affinis* Brook.

Distribution.—The type locality, 35°39'S, 50°47'W, is off Montevideo, Uruguay (*Challenger* sta. 323). All the *Eltanin* specimens were collected in the southern oceans.

Schizopathes affinis Brook, 1889
Fig. 2

Schizopathes affinis Brook, 1889:148–150, pl. IX, figs. 1–6.—Cooper, 1909: 310, pl. 41, fig. 1–2.

Bathypathes (Schizopathes) affinis.—van Pesch 1914:27 (part).—Zhou & Zou, 1992:46–47.

Material examined.—Western Atlantic, Bahamas, Tongue of the Ocean, 25°16.00' N, 77°45.3' W, 2780 m, R/V *Columbus Iselin* sta. 172, 8 Feb. 1974 (2 specimens, USNM 59011).—Western Atlantic, Bahamas, Tongue of the Ocean, 25°16' N, 77°42.16' W, 2911 m, R/V *Columbus Iselin* sta. 288, 11 Nov 1974 (1 specimen, USNM 59009).

Description.—Colony monopodial, unbranched, but pinnulate (Fig. 2B). Pinnules simple, up to 20 cm long in colonies 30 cm tall, and arranged alternately in two lateral rows along stem; decreasing in length toward apex of corallum; and inclined upward (distal angle formed with stem ~60° for lowermost pairs, decreasing to 30° or

less for those near apex). Lowermost pinnules mostly 8–10 mm apart in each lateral row, decreasing to 5–6 mm apart near top of corallum. Interior angle formed by pinnules in opposing rows generally 180°.

Spines small, triangular and compressed; arranged, with varying degrees of regularity, in axial rows (4–5 rows visible in lateral view); 0.15–0.20 mm apart in each row (about six per millimeter). Spines usually 0.03–0.04 mm tall (from midpoint of base to apex), but occasionally up to 0.08 mm near the distal end of pinnule. Abpolypar spines equal to or slightly smaller than polypar spines.

Polyps (Fig. 2A) uniseriably arranged, on front or upper side of pinnules; 3.0–4.5 mm in transverse diameter; about three polyps per centimeter. Polyps slightly reduced in size at base of pinnules and on stem.

Discussion.—Several features of the type specimen of *S. affinis*, including the pronounced triangular shape of the corallum, the relatively long unpinnulated stalk, and the very distinctly curved hook at the end of the holdfast, are also evident in two of the *Columbus Iselin* specimens. The unpinnulated stalk is 12 cm in the type specimen and 10–12 cm in the *Columbus Iselin* specimens from sta 172, but only 7.5 cm in the specimen from *Columbus Iselin* sta. 288. Other features of the type, such as the size of the spines and polyps, were not specifically described by Brook; however, based on the illustrations given, it can be estimated that the spines in the type are not more than 0.06 mm and the polyps not more than 4.5 mm in transverse diameter. In the *Columbus Iselin* material, the spines on the pinnules are mostly 0.03–0.04 mm, although in places they reach 0.08 mm, and the polyps (only present in the specimen from *Columbus Iselin* sta. 288) are 2.4–3.2 mm in transverse diameter.

Brook (1889) states that the spines on the flattened section of the unpinnulated stalk are confined to the wider lateral sides. In the *Columbus Iselin* material, the spines occur on the lateral sides on the upper portion

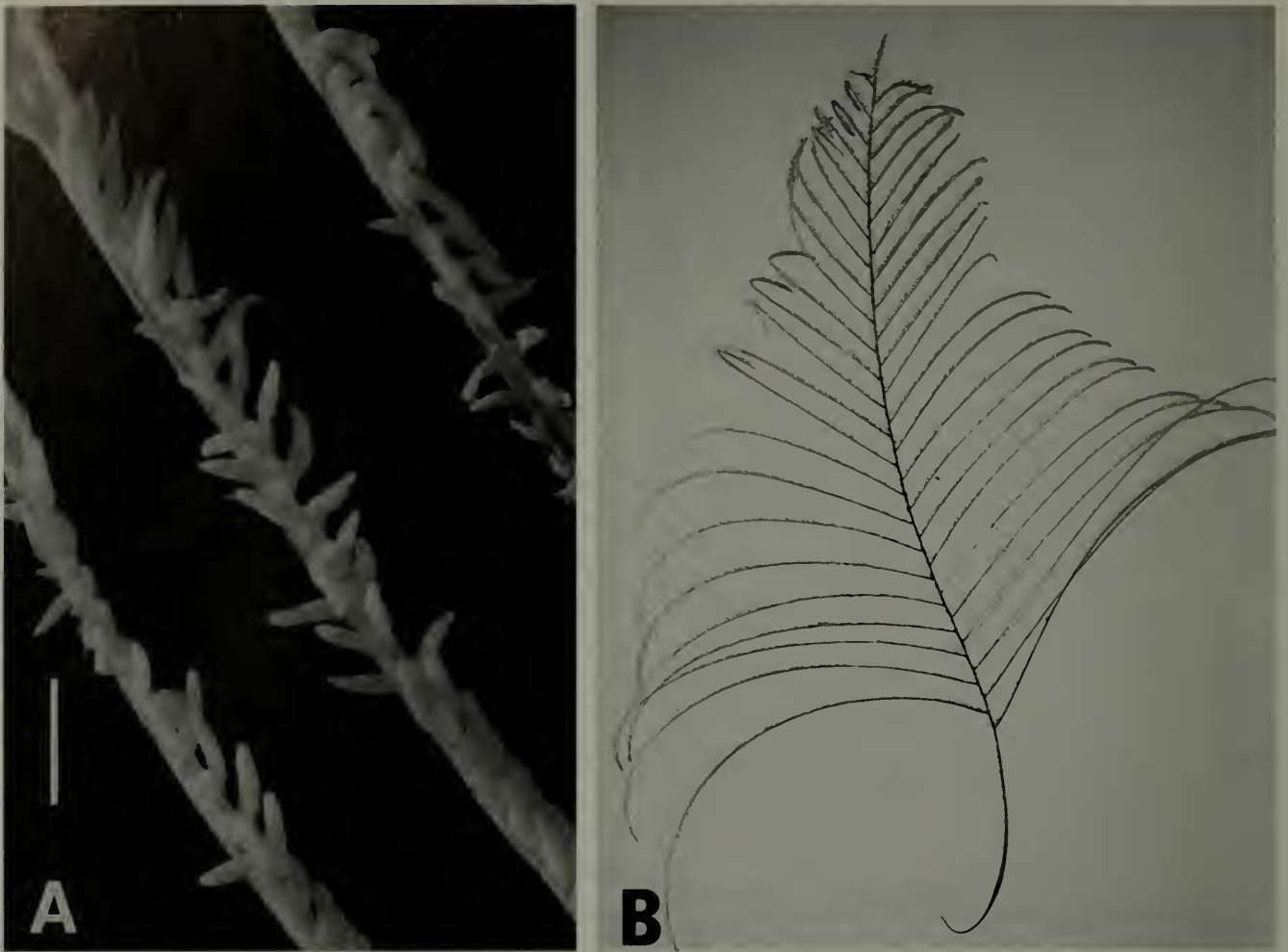


Fig. 2. *Schizopathes affinis* Brook, USNM 59009. A. Pinnule with polyps; scale equals 3 mm. B. Corallum; height 28.5 cm.

of this section of the stalk, but along the narrow front edge further down towards the base.

Comparisons.—According to Brook (1889), *S. affinis* can be differentiated from *S. crassa* by a greater curvature in the hooked base, and by a more pronounced triangular shape caused by a more abrupt decrease in length of the pinnules from the lower to the upper parts of the corallum. The *Columbus Iselin* and *Eltanin* specimens tend to follow this pattern. For colonies of comparable size (about 30 cm), the ratio of the length of the lowermost pinnules to those 10 cm higher up on the axis is less than 0.5 in *S. affinis* and more than 0.5 in *S. crassa*. An analysis of a much larger suite of specimens would be needed to determine if this pattern is consistent for specimens of all sizes. From the limited number of specimens examined, it appears that col-

onies of *S. crassa* reach a larger maximum size than *S. affinis* (i.e., >50 cm in height).

The major features that can be used to distinguish *S. affinis* from *S. crassa* are the size of the spines and polyps. The pinnular spines in *S. affinis* are typically 0.03–0.04 mm, but occasionally reach 0.08 mm. In contrast, the pinnular spines in *S. crassa* are usually 0.06–0.08 mm and sometimes as large as 0.10 mm.

Brook (1889) reported that the polyps of *S. affinis* were smaller than those in *S. crassa*. Although polyp size was not specifically mentioned in the type description of *affinis*, the type illustrations do indicate a slight difference in polyp size between the two species (maximum of 6 mm in *crassa* and 4.5 mm in *affinis*). In the *Eltanin* specimens of *S. crassa* the polyps on the pinnules are 4–6 mm in transverse diameter, whereas those in the *Columbus Iselin* specimens of *S. af-*

finis are not larger than about 3.2 mm. These data support Brook's conclusions.

Brook (1889) also states that the spines in *S. affinis* are more numerous than those in *S. crassa*. Although estimates made from the type illustrations indicate a spine density of about 3/mm in both species, the *Columbus Iselin* and *Eltanin* specimens indicate a density of about 6/mm for *S. affinis* and 3–5/mm for *S. crassa*.

Distribution.—Cosmopolitan. Four of the type specimens and the colony described by van Pesch (1914) were collected in the western Pacific, off the Banda Islands. The fifth type specimen was obtained west of the Admiralty Islands. The species has also been reported from the Indian Ocean (Cooper 1909) and the South China Sea (Zhou & Zou 1992). The *Columbus Iselin* specimens were collected in the Western Atlantic, near the Bahama Islands.

Schizopathes amplispina, new species

Figs. 3–4

Material examined.—Indian Ocean, east of Madagascar, 21°18'S, 36°18'E, 1510–1600 m, R/V *Anton Brunn* sta. 399C, 10 Oct. 1964 (3 specimens; holotype USNM 96966, paratypes USNM 96967).

Diagnosis.—Corallum monopodial, unbranched, but pinnulate (Fig. 3). Pinnules simple, arranged alternately and bilaterally; spaced 6–8 mm apart in each row on lower section of stem, decreasing to 2–5 mm apart near apex. Spines on basal half of pinnules small, triangular and compressed; 0.04–0.10 mm from midpoint of base to apex (Fig. 4D); becoming larger (0.12–0.18 mm) and less symmetrical on upper parts of pinnules (Figs. 4A–B). Polyps transversely elongated; 3.0–3.5 mm from distal side of distal lateral tentacles to proximal side of proximal lateral tentacles; arranged uniseriably, with about three polyps per centimeter.

Description.—Holotype about 42 cm tall; unpinnulated stalk 8 cm; tip of stem and basal end of stalk missing. Stem com-

pressed laterally in plane at right angles to plane of pinnules; most strongly compressed along midsection of unpinnulated stalk (axis about 1 mm wide across anterior edge, but 3.5 mm along sides). Unpinnulated stalk sigmoidal; upper portion curved slightly away from polyp side of corallum, midsection curved strongly anteriorly, lower section curved strongly posteriorly. Basal end of holdfast pointing away from abpolypar side of corallum; flattened, spatula-like near tip, with ridge extending down center of one side.

Lowermost pinnules 24 cm long; pinnules 10 cm higher on corallum about 19 cm long; those 10 cm higher about 16 cm; and smallest pinnules near apex 2–3 cm long. Pinnules spaced 6–8 mm apart on lower parts of corallum, decreasing to 2–3 mm apart near apex; inclined upward (distal angle formed with stem 55–60° for lowermost pairs, decreasing to about 30° at apex). Largest pinnules about 1.0 mm in diameter at base and 0.5–0.6 mm in diameter near midpoint. Rows of pinnules nearly opposite (interior angle about 180°) over most of corallum; lowermost pair forming acute interior angle; uppermost pairs anterolateral or posterolateral in position.

Polypar spines on basal half of pinnules (axis diameter 0.5–1.0 mm) triangular and symmetrical (Fig. 4D); 0.04–0.10 mm tall (from midpoint of base to apex); abpolypar spines 0.04–0.07 mm. Polypar spines on distal parts of pinnules (axis diameter 0.3–0.4 mm) large, less symmetrical, sometimes pointing proximally (Figs. 4A–B); 0.12–0.18 mm tall (from midpoint of base to apex); abpolypar spines 0.10–0.12 mm. Bifid and double spines present on distal parts of pinnules, but usually absent on lower sections. Spines arranged in axial rows of varying regularity; 2–4 rows visible in lateral view on basal section of pinnules; 4–5 rows visible along distal section. Spines in each row mostly 0.25–0.35 mm apart (range 0.2–0.4 mm); with 4–5 spines per millimeter in each row. Rows of spines on unpinnulated stalk confined to wider sides



Fig. 3. *Schizopathes amplispina*, holotype USNM 96966; height 42 cm.

(2–3 rows on each side) above, but with rows converging near anterior edge further down. Spines absent on lowermost 2 cm of stalk.

Polyps transversely elongated; 3–3.5 mm from distal side of distal lateral tentacles to proximal side of proximal lateral tentacles; arranged uniserially, usually on the distal or anterior side of the pinnules, with about three polyps per centimeter.

Discussion.—The two paratypes are about the same size as the holotype and are

very similar in several other respects. The unpinnulated section of the stem is 8–9 cm long, the lowermost largest pinnules are 24–26 cm long, those 10 cm higher are 18–20 cm and those 10 cm higher are 14–16 cm. The pinnules are as crowded together in the paratypes as they are in the holotype, the distance between adjacent pinnules in each lateral row never being more than 8 mm, even for the lowermost pairs. In all three of the type specimens the stem and the lower sections of the larger pinnules are

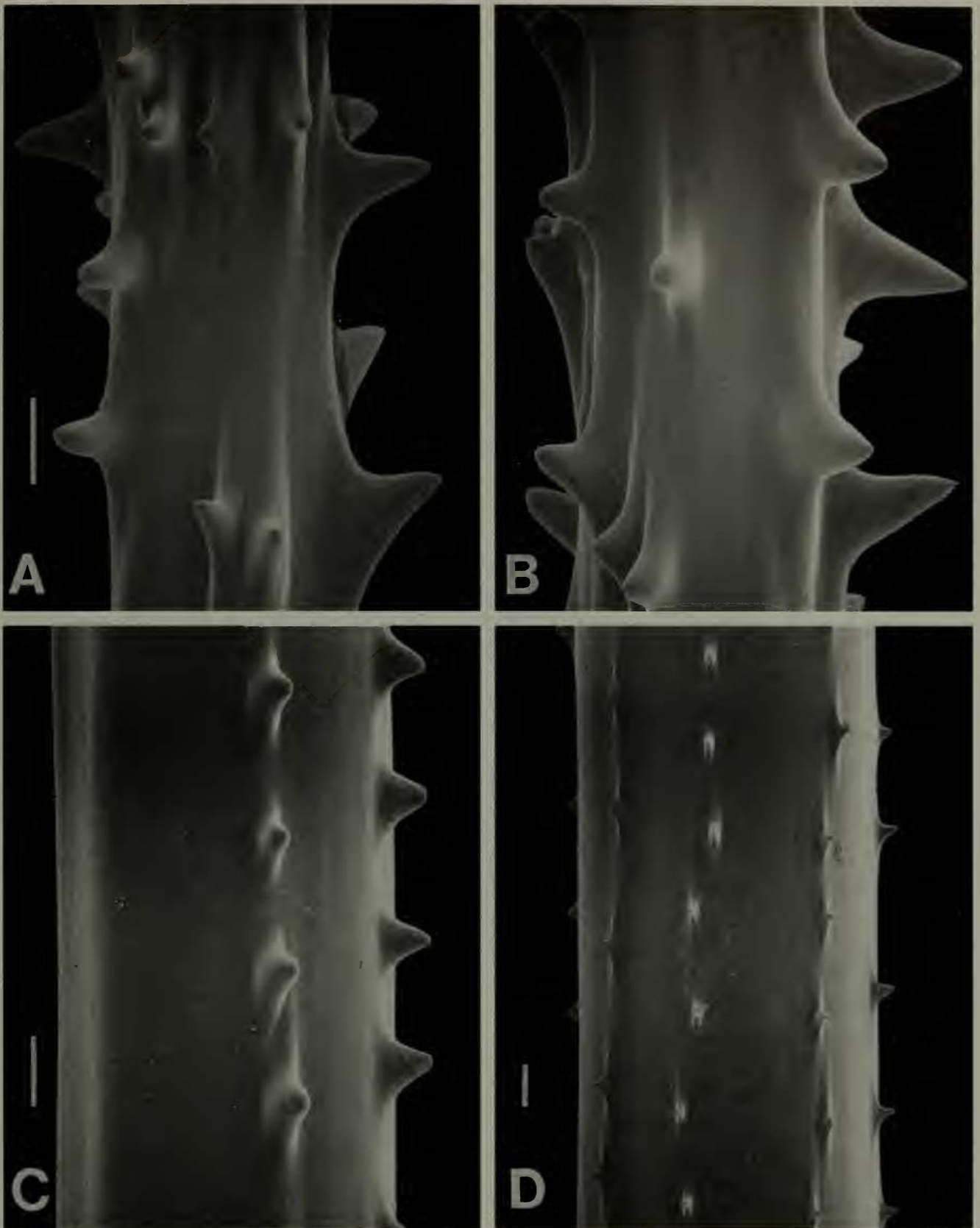


Fig. 4. *Schizopathes amplispina*, holotype USNM 96966. A. Distal section of pinnule; scale equals 0.1 mm. B. Distal section of pinnule; scale as in A. C. Midsection of pinnule; scale equals 0.1 mm. D. Basal section of pinnule; scale equals 0.1 mm.

compressed laterally such that their widest (anterior to posterior) axis is at right angles to the plane containing the pinnules.

As in the holotype the largest spines in both paratypes occur along the distal half of the pinnules and on the side of the pinnules corresponding to the polyp side of the corallum. On the basal sections of the larger pinnules, where the axis is compressed laterally, the rows of spines are not always evenly distributed around the circumference of the axis, and in some places the appearance is given that spines are missing from one side (Fig. 4C). Near the basal end of holdfast, the stem is compressed laterally in the same direction as the upper part of the stem in one specimen, but flattened at right angles to the upper part in the other two specimens. In the latter case, there is a small keel (defined by the central axial canal) extending down the center of one side. The basal end of the holdfast ends in a rounded point.

In none of the specimens are polyps present on all parts of corallum, and only in the holotype can the polyps be measured with any degree of reliability. In the holotype the polyps at the distal ends of the pinnules measure 3–3.5 mm in transverse diameter; they are about the same size or slightly smaller in the middle of the pinnules.

Comparisons.—This species can be differentiated from *S. crassa* and *S. affinis* by its much larger spines (0.08–0.18 mm vs. 0.1 mm or less) and its much more closely spaced pinnules (7–8 mm apart in *S. amplispina* vs. 8–16 mm apart in the other species). Furthermore, both the pinnules and the stem are much more strongly compressed in *S. amplispina* than in the other two species. In the size of its polyps (maximum of 3.5 mm transverse diameter near the tips of the pinnules), *S. amplispina* resembles *S. affinis* (polyps 3–4.5 mm) more than *S. crassa* (polyps 4–6 mm).

Etymology.—Latin *amplius*, larger, and

spina, spine; in reference to the large spines on the distal sections of the pinnules.

Distribution.—Known only from the type locality.

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